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DECLARATION

I, Peter Johnson, BA MITI, of Beacon House, 49 Linden Road, Gosforth, Newcastle upon Tyne, NE3 4HA, hereby certify that to the best of my knowledge and belief the following is a true translation made by me, and for which I accept responsibility, of
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Method of determining the living character of an element carrying a fingerprint

The present invention concerns a method of checking the living character of a finger by means of a fingerprint sensor. The invention also confirm the fingerprint sensor for implementing this method.

In general terms, any protected access becomes accessible to an authorised person by a means that he alone possesses. One of the means of limiting access to a person is to require the fingerprint of this person. The image of the fingerprint of a person is obtained by a fingerprint sensor. Once the image of the print is obtained by the sensor, it is transmitted to an image processing unit that compares the image obtained with a bank of print images so as to check that the print taken by the sensor is known. Recognition of the print by the image processing unit then opens up, to the person to whom the print corresponds, access to that which he seeks.

It has been found that, although identification by fingerprints is a known method, it still poses problems. This is because there are many forgers who attempt to deceive fingerprint sensors with imitations. The artifices in particular used are false fingers.

In order to thwart such forgers, several methods have been proposed for determining whether the element carrying the fingerprint is living. Certain methods use optical means. This is for example the case with the document US-A-5 719 950, which describes a method consisting of measuring biometric parameters such as the oxygen level in the blood, the

temperature of the skin, etc. The document US-A-5 737 439 describes an optical measurement system for detecting blood flow by means of two wavelengths. Other methods consist of making electrical measurements. This is the case with the document JP-A-11197135, which describes the measurement of variations in capacitance between two electrodes, and the document US-A-5 953 441, which describes a device for measuring the complex impedance of the finger and comparing it with reference curves which are a function of frequency.

It has been found through the measures already known that the measurement of the impedance of the finger is one of the methods best suited to checking the living character of a finger. The technique consists of measuring an impedance Z between two electrodes and comparing the value obtained by this measurement with a range of values considered to be acceptable. The technique is still sometimes deceived by imitations and discrimination errors remain numerous.

The aim of the invention is therefore to propose a method of determining the living character of an element carrying a fingerprint by means of a fingerprint sensor.

To this end, the invention concerns a method of determining the living character of an element carrying a fingerprint, characterised in that it consists of making on the one hand at least one electrical measurement and on the other hand producing an image of the said fingerprint, then validating the said or each electrical measurement by comparing it with a range of values of electrical measurements defined by a pre-established relationship linking the said range with characteristics of the said image.

According to another characteristic of the invention, the said electrical measurement is a measurement of impedance.

According to another characteristic of the invention, the said method consists of linking the said characteristics of the image of the print and the said range of acceptable values, grouping together the said characteristics of the image in the form of a grade, the said grade corresponding to a range of values of predefined electrical measurements.

The invention also concerns a fingerprint sensor making it possible to determine the living character of an element carrying a fingerprint. The sensor is characterised in that it comprises means designed to implement the method according to one of the preceding claims.

The characteristics of the invention mentioned above as well as others will emerge more clearly from a reading of the following description of an example embodiment, the said description being given in relation to the accompanying drawings, amongst which:

Fig. 1 depicts a fingerprint sensor according to the invention covered with an element carrying a print;

Fig. 2a depicts an element carrying a print where the print is wet;

Fig. 2b depicts an element carrying a print where the print is dry;

Fig. 3a depicts the image of a wet print taken by the fingerprint sensor according to the invention;

Fig. 3b depicts the image of a dry print taken by the fingerprint sensor according to the invention.

In the method according to the invention, the determination of the living character of an element carrying a fingerprint is made by electrical measurements on it. These measurements preferably consist of measurements of impedance. The measurement of the impedance Z is made, as depicted in Fig. 1, by a fingerprint sensor 1 placed in contact with the element carrying the print, here represented by a finger D. An optical system SO is placed at the base of the sensor 1 so as to produce an image of the print of the finger D. The fingerprint sensor 1 according to the invention comprises a plate 10 of transparent material, for example glass or transparent plastics material, making it optically possible to photograph the print of the finger D. On the surface 11 of this plate 10 electrodes Ei and Ej are disposed, between which an impedance Zij is measured. Measurement of the impedance Zij between the electrodes Ei, Ej is made possible by virtue of conductive transparent connections 20. These connections 20, also placed in contact with the plate 10, must necessarily be conductive and transparent so as to enable the sensor 1 to fulfil both its function as an image sensor and its function as a verifier of the living character of the finger. The transparency of the connections 20 is preferably obtained by a vacuum deposition of a very fine layer of material, preferably ITO (Indium Tin Oxide), with a thickness of less than one micrometre. The whole of the surface of the sensor 1 with the exception of the electrodes Ei, Ej is covered with a layer of an insulating material 30 offering only the electrodes Ei, Ej in contact with the finger D.

In the method according to the invention, on the one hand the measurement of the impedance Zij of the finger D between two electrodes Ei, Ej is made and on the other hand the image Ie of the print of this finger D is produced by means of the optical system SO. Measuring the impedance Zij makes it possible to verify the living character of the finger by comparing the value of the impedance Zij measured with a range Iv of values judged to be acceptable for a living finger. This range of values must be defined with precision in order to accept all living fingers, even those having unusual characteristics, but rejecting false fingers having characteristics close to living fingers. This range Iv of acceptable values is defined in the invention for each of the fingers D present on the sensor 1 according to the characteristics of the image Ie of the print.

Figs. 2a, 2b, 3a, 3b depict a finger D and the image Ie of its print. In these figures, it can be seen that the print of the finger D has a relief formed from hollows, also referred to as valleys V, and protrusions, also referred to as ridges R (ridges in English terminology). On the image Ie of the print, the valleys V appear in black and the ridges R in white. Each finger D at a given time T, gives a unique image Ie possessing particular characteristics. These characteristics are for example the contrast, the average greyscale of the images, the width of the ridges R, the average greyscale of the ridges, etc. The characteristics of the image Ie are due to characteristics of the finger D, such as for example the moisture. In practice, the various characteristics of the image Ie are collected together in the form of a grade, for example between 0 and 1. Therefore an image Ic of a given print corresponds to a given grade.

A moist finger Dh has been shown by way of example in Fig. 2a.

The image Ieh of a print of this moist finger Dh has particular characteristics. It can be seen for example in Fig. 3a that a moist finger Dh brings out the contrast of the image Ieh of the print. Inversely it can be seen in Figs 2b and 3b that a dry finger Ds gives an image Ies of the print of this finger Ds that is not highly contrasted. It will be noted that the moisture of the finger D is not the only characteristic of the finger D to act on the characteristics of the image Ie. In general terms, several characteristics of the finger D have an influence on several characteristics of the image Ie of the print.

In the method according to the invention, several of the characteristics of the image Ie of the print of the finger D are used to determine the grade corresponding to the image Ie of the print. Each grade between 0 and 1 is associated with a range Iv of predefined impedance values. Thus, from the image Ie of the print of the finger D, a grade is determined corresponding to a range Iv of possible values for the finger D at a given time T. Next the impedance value Zia found by the measurement between two electrodes is compared with this range Iv of acceptable values and it is verified that the impedance value Zij measured belongs to the range Iv thus defined. If the impedance value Zij measured belongs to the range Iv, it will then be accepted that the finger D is living, otherwise the finger D will be rejected by the sensor 1.

The method according to the invention can be implemented in parallel to other methods of determining the living character of an element carrying a fingerprint, such as for example a method consisting of verifying the correlation between the impedance measured and the surface area of the measuring electrode